

## 6.—The history of two coastal lagoons at Augusta, Western Australia

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### Abstract

The Deadwater and Swan Lake are two small lagoons which form appendages to the estuary of the Blackwood River near its mouth. Neither was a part of the estuary when the first white settlers arrived in 1830; Swan Lake was then a fresh-water lake with a stream to the estuary and the Deadwater is not shown at all on early maps. The Deadwater now has the characteristic form of a coastal lagoon that has developed as the result of diversion of the river mouth parallel to the shore behind a wave-built barrier on a prograding coast. The mouth is known to have migrated some distance eastwards during the 1930s and the river then flowed through what is now the Deadwater. The bar closed for the only time on record in 1945 and was reopened near its original site. This left the Deadwater as a coastal lagoon behind low dunes and the coastal alignment is now almost identical with that of the 1830s.

### Introduction

This enquiry into the origin of the Deadwater and Swan Lake at the mouth of the Blackwood River has arisen out of a study being made for the Environmental Protection Authority of

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Western Australia into all aspects of the estuarine ecosystem (Hodgkin, 1976). These two lagoons have been added to the estuary in this century and are now a significant part of it, at least from the biological point of view. It is of considerable interest to understand how this came about, to know whether the events described were the result of natural processes or are attributable to human interference. Was the formation of the Deadwater a fortuitous event caused by vagaries of short term climatic change or was it caused by human activities? Is it evidence of a prograding coastline with an excess of mobile sand?

The following history has been pieced together from a few documents, from old maps and air photographs, and from the sometimes conflicting accounts given by local inhabitants of what happened 30 to 50 years ago.

### The catchment and the estuary

The Blackwood River is the largest river of the south west, with an estimated average annual discharge of  $1\ 057 \times 10^6 \text{ m}^3$ , more than twice that

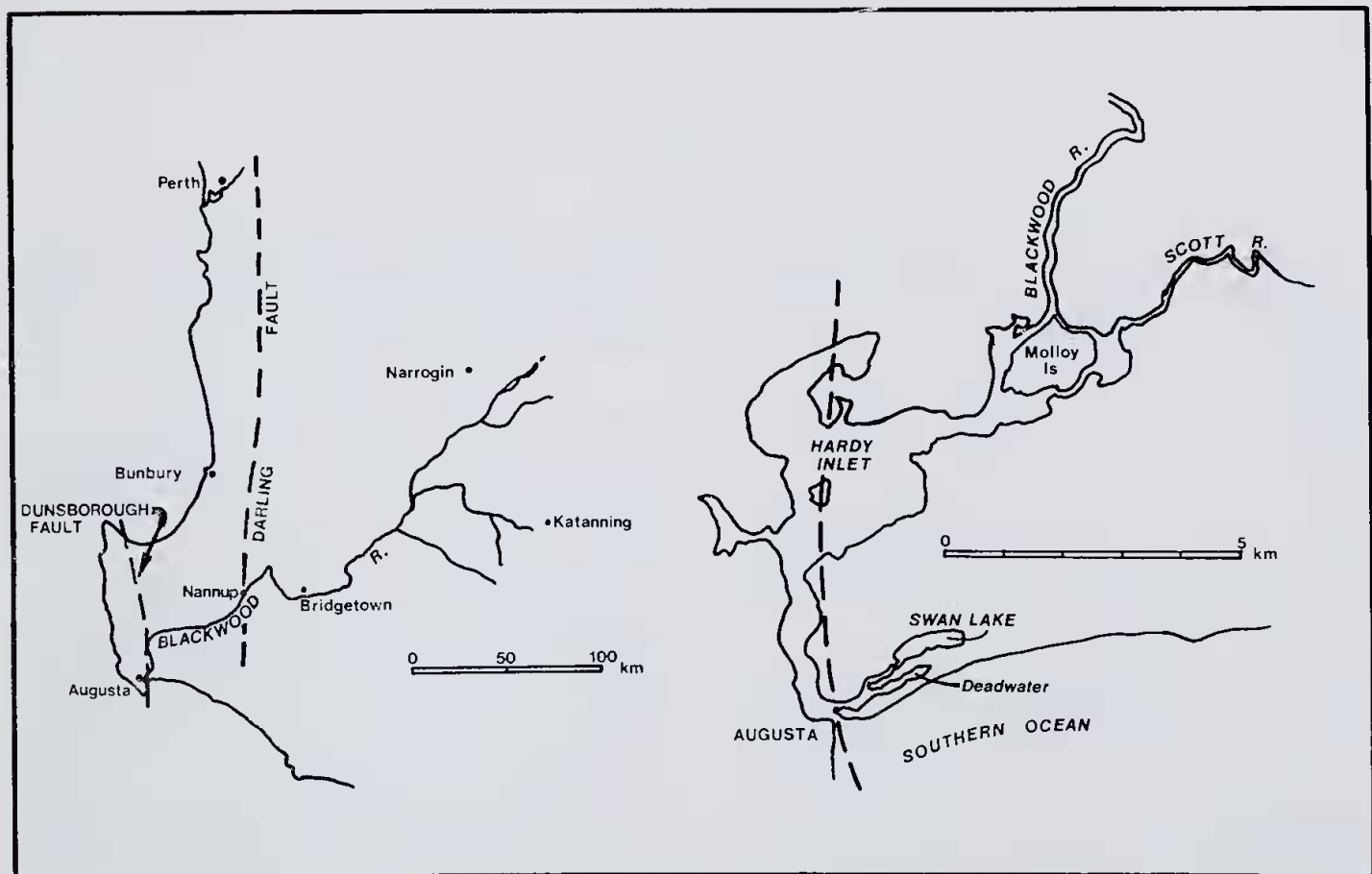


Figure 1.—Locality map and map of the Blackwood River estuary.

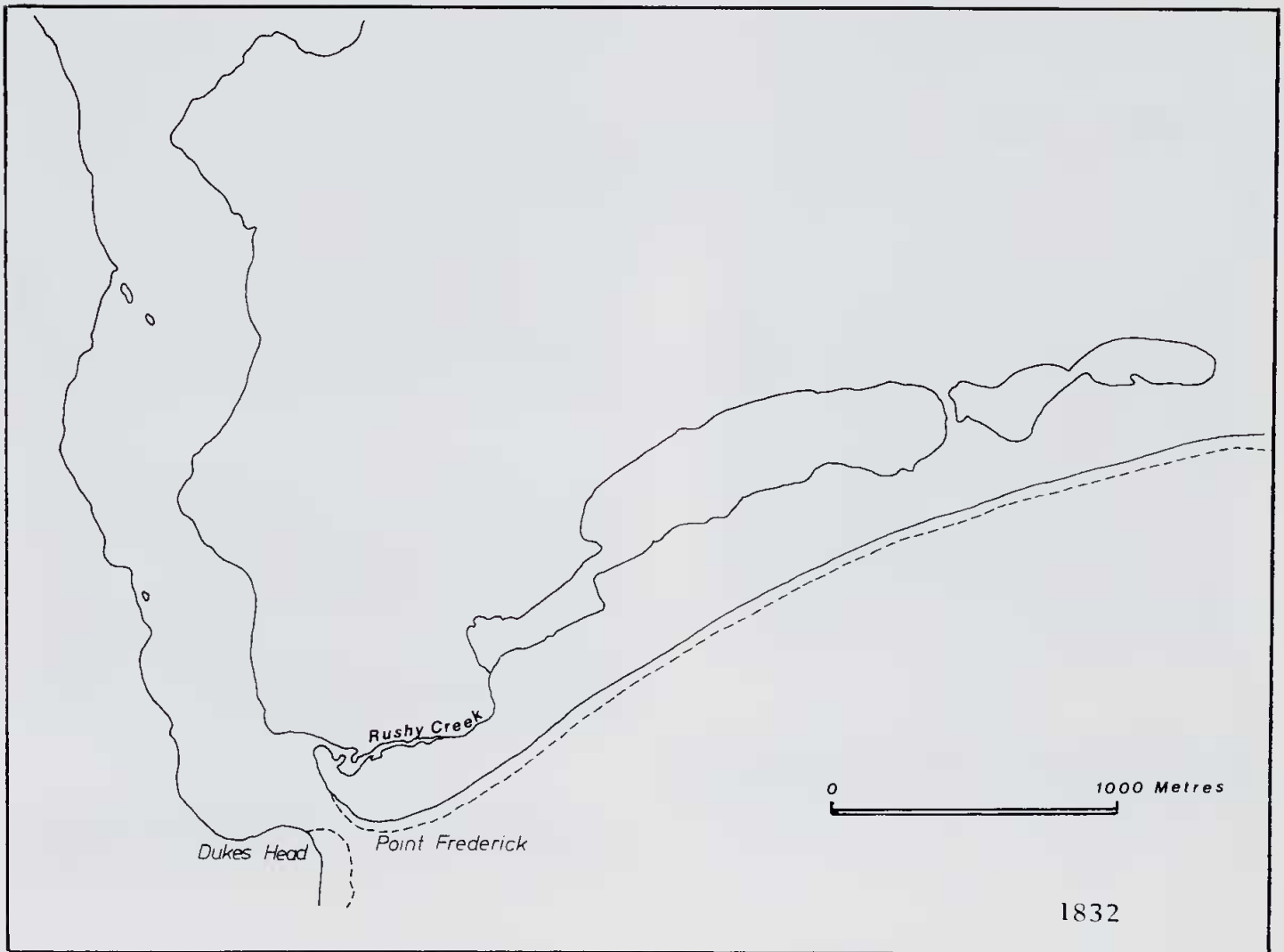


Figure 2.—Tracing from map dated 1832-4-8. This and the subsequent figures have all been reduced to the same scale. Broken lines outline sand banks.

of the Swan River with its larger catchment. Floods have resulted in discharge rates in excess of  $480 \text{ m}^3/\text{sec}$  (Public Works Department, Western Australia, 1972). Flow is extremely seasonal with 97.5% of river runoff occurring during the six months June to November (as measured at the nearest gauging station). In consequence the estuary is fresh throughout in winter and brackish to marine in summer, often with extreme stratification of the water body.

Tides though small (maximum daily range about 0.6 m) are little damped in the estuary proper and strong tidal currents flow in and out of the two lagoons. The Deadwater is stratified in winter, surface water may be fresh and that below the level of the sill about half sea water salinity.

The Dunsborough Fault runs north-south through the estuary (Fig. 1). To the west of this is the Naturaliste-Leeuwin ridge of Precambrian rocks while to the east there are Mesozoic sediments of the Donnybrook Sunland and Quaternary sands of the Scott Coastal Plain where three old shore lines are recognised parallel to the present coast (Lowry, 1967). The estuary is 42 km long; the greater part is a tidal river 50 to 100 m wide and about 5 m deep

which discharges into the small, very shallow, Hardy Inlet with a deep channel to the mouth and bar. The mouth is sheltered from the predominantly westerly winds in winter by the Leeuwin ridge, but is exposed to strong southeasterly winds in summer.

#### 1830

Early maps and paintings by Thomas Turner make it clear that when Captain Stirling and the early settlers came to the Blackwood in May 1830 the mouth of the river was where it is now. The first map, dated 1832-4-8 by Hillman, Turner and Edwards represents an accurate survey of the lower part of the estuary. On this map (Fig. 2) Dukes Head and Point Frederick and their associated sand banks have much the same form they have now. To the east of the mouth the shore line was where it is now.

Unfortunately there is no indication of the nature of the shore and it can only be assumed that then as now there were low dunes. The large Swan Lake had its present size and shape and a smaller lake extended about 1 km further east. A small winding stream, Rushy Creek, flowed from the lake to the estuary near its mouth. There was no Deadwater.

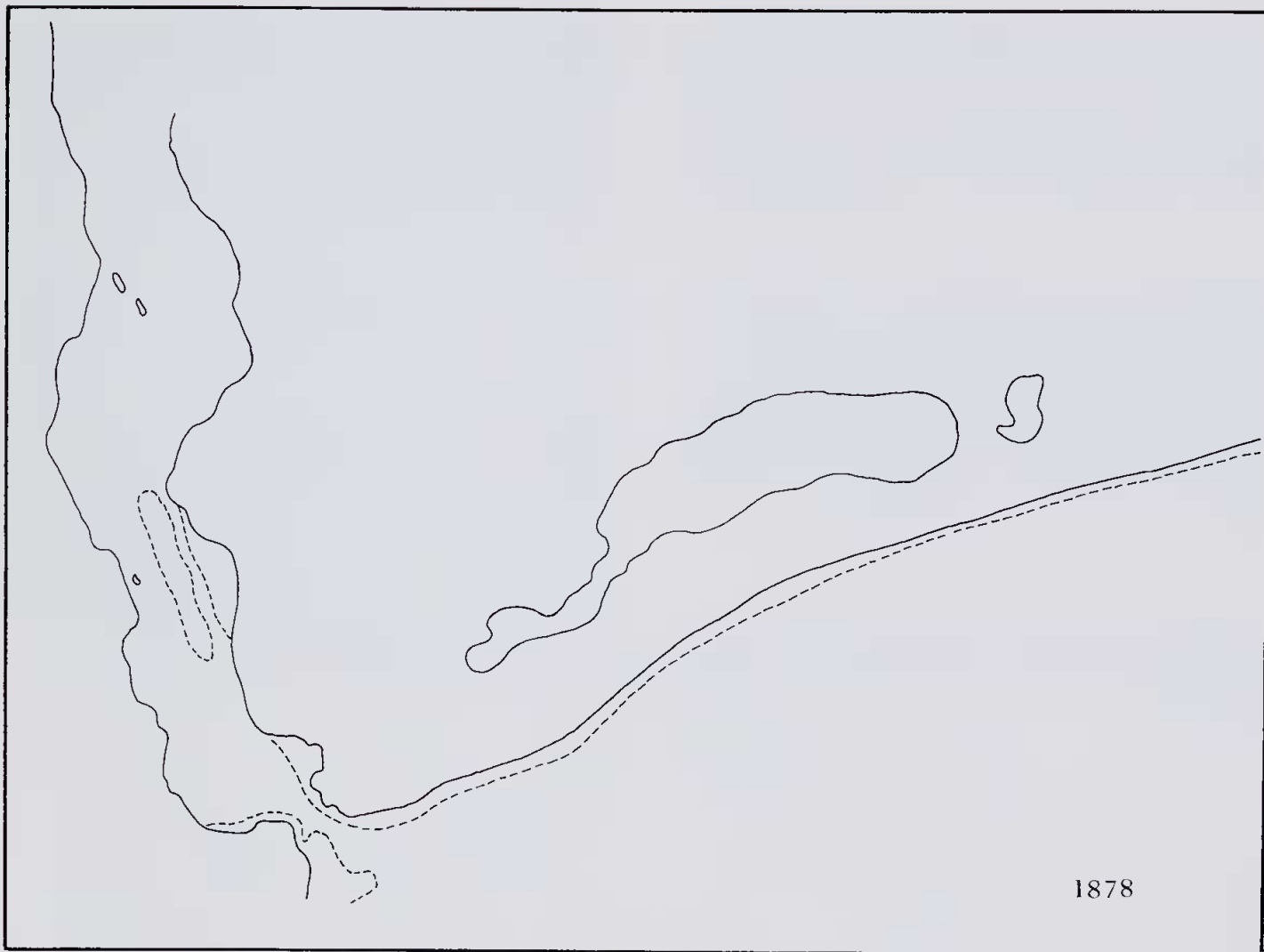


Figure 3.—Admiralty chart dated 1878.

1878

The Admiralty Chart (Fig. 3) only shows the coastal features in detail, as is usual in these charts. Again the mouth and shore line are depicted with essentially their present form. Low dunes are shown in what is now the western end of the Deadwater.

A "Townsite" plan dated 1899 appears to show considerable erosion of Point Frederick, but it is difficult to match this plan to other maps and photographs.

1925

A detailed hydrographic survey of the channel part of the estuary (Public Works Department, Western Australia, 23962) again shows the mouth with much the same form as in 1830 (Fig. 4). A low sandy patch extends 150 m east from Dukes Head and the mouth has moved slightly east at the expense of Point Frederick which has retreated about 100 m. The eastern shore line is unbroken; there is nothing to show where Rushy Creek discharged. The survey was made in April and the mouth of the creek was probably blocked with sand.

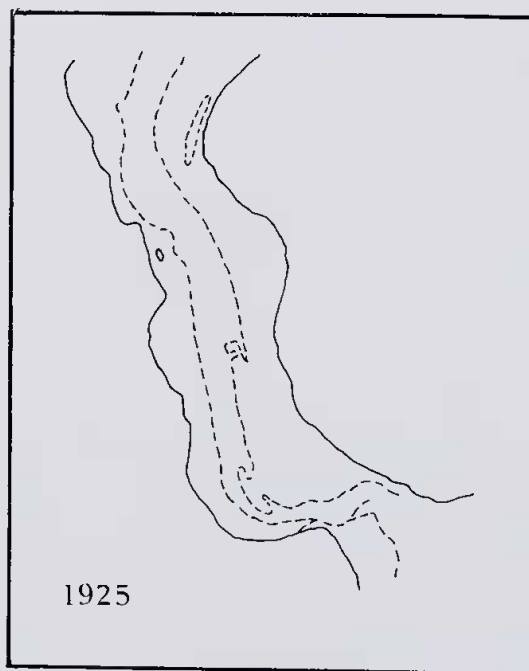


Figure 4.—Public Works Department, Western Australia, chart dated 1925.

1929

By this date: "the bar has so silted up that getting into or out of it from the Bay is a matter of impossibility" and "The mouth of the Blackwood is fast being blocked by a sand bar a few chains in width ..." (Letters on Fisheries Department file 165/21). There is no indication where the mouth was at this time.

1933

Now "the opening to the sea is about a mile east and each year sees it moving further eastward, the rate of movement has been fairly rapid, the present distance of about a mile being covered in the last twelve years" (letter from Augusta-Margaret River Shire, 29/4/1933). The letter petitions the Minister for Works to make a survey and re-open the old entrance, because of shallowing of the bar and an adverse effect on the fishing industry.

1943

Between 1933 and 1943 the mouth did not in fact move much further east; movement seems to have ceased when the mouth came to a big dune about 2.5 km from the old mouth. An air

photo taken 20/11/1943 (Fig. 5) shows the river flowing in a channel 100 to 200 m wide through what is now the Deadwater to the new mouth. Between this and the sea there is a sand spit 200 to 300 m wide that extends from Dukes Head to the new mouth.

It is clear from the correspondence and from the recollection of local residents that between 1925 and 1930 the sand round Dukes Head built out eastward as a broad spit and that Point Frederick retreated, in spite of an attempt to stabilise it with marram grass about 1927 or 1928. By 1930 the spit was sufficiently consolidated for people to drive along it in trucks and fish from them into the estuary. Light planes landed and took off on the spit and the perilously short landing strip was reportedly about opposite the present entrance to Swan Lake from the Deadwater; a photograph dated 1st January 1931 shows a Tiger Moth plane on the spit close to the then mouth. The air photo shows that the spit was wider than the present beach ridge and the shore line about 100 m seaward of its position today, or in 1830. Scattered vegetation grew on the western half but this was probably only pioneer plants such as *Arctotheca populi-jolia* which colonise open sandy shores.

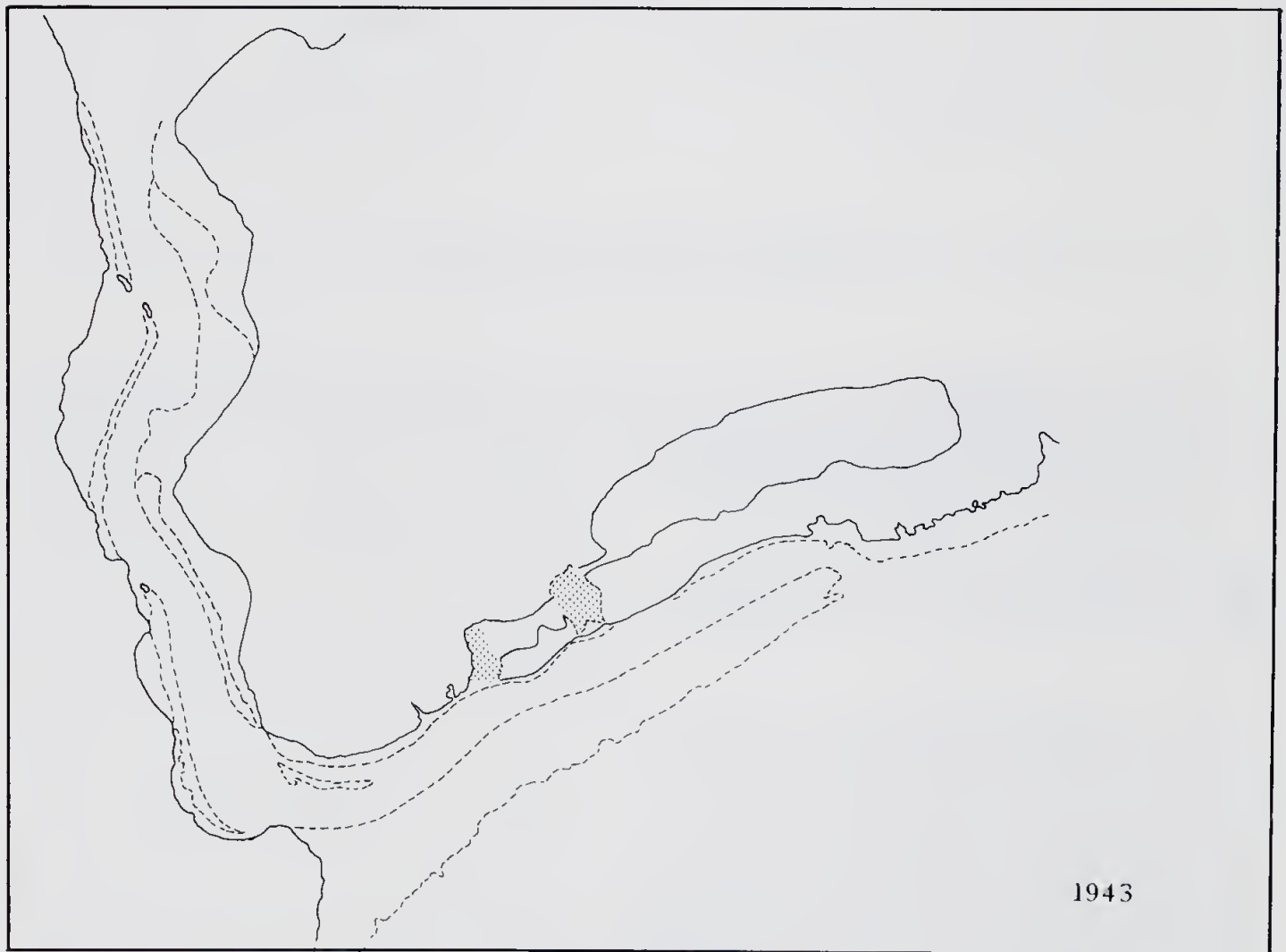


Figure 5.—Tracing from air photo of 1943. Stippled areas: bare sand, thought to be the result of attempts to block the creek.



There is no evidence that the bar ever closed during this period, though it was evidently very shallow. There were continual complaints from fishermen both because the passage was dangerous and because the bar was believed to obstruct the entry of fish. Whatever the condition of the bar in summer a considerable volume of water flowed through the new channel and mouth in winter keeping them scoured out.

#### 1945

The events of this year are told in an article in the West Australian newspaper by Noel M. Brazier, dated 14th July 1945 and entitled: *Opening the Blackwood, how the river reached the sea again.*

"By the middle of March this year the water of the Blackwood River was barely flowing over its long sand bed where it entered the sea. The whole landscape of the river mouth had altered from what it was some 54 years ago; the new mouth had been diverted from its then course to about one mile east.

"For some years small round sand hills had filled the previous outlet of the river and continued east for nearly a mile ...

"By the end of March the river mouth had silted up; strong winds from the sea had raised the outlet some 3 ft. The river was completely shut off from the sea; fishing was bad. Seeing the danger to the low-lying land adjacent to the river Keith McWhae now permanently residing there, took his instruments out to find the easiest place to let the water out. He decided the best place was close to the natural outlet of over 50 years before.

"The people were anxious and appealed to the Government. Two engineers came down and agreed with Mr. McWhae but they said no men could be spared to do the work. The river had now risen some 4 ft. and the camping ground was flooded.

"The work must be done—or where would the water rise to? So a team of men started to work at the selected spot—and some of the sand hills were fairly high. Yet they got the water through in a small stream; the trouble did not end there. The sand hills began falling in; ... But three men stuck it out for five days, when the strength of the river suddenly began to break through. They had succeeded.

"A huge gap, 100 yards wide and many feet deep, was torn through the cut and in a few hours had lowered the height of the river some 4 ft. The troubles of the mouth were over. The cost in wages was less than £18. The fish from the sea can now reach the river; again the Blackwood will become a good fishing ground, and the friendly porpoise sport around".

Local residents still recall the spectacular out-rush of river water that spread as far as St. Alouarn Island 9 km from the mouth and carried with it fishermen's nets which had been set in the estuary.

The Public Works Department did in fact prepare a plan (Public Works Department, Western Australia, 23962 dated 24/5/1945) for a channel 325 m long across the bar.

The locality sketch shows "high sand hills" where the mouth is now and the proposed channel is marked about 400 m east of this where the highest point on the bar was about 1.5 m above sea level. This was probably the "selected spot" referred to above.

It would be interesting to know the actual date on which the bar was breached. River flow data, as recorded at Nannup 140 km upstream, show that even in May flow had increased little above the low summer levels and it was only in mid-June that the river began to flow strongly. Fortunately 1945 was a wet winter with the greatest river flow recorded in the 17 years for which there are records (Public Works Department, Western Australia, Water Resources Section, 1972) and the river scoured out for itself a good entrance which has never again closed.

#### 1955

Air photos taken 23/5/1955 and 3/12/1955 (Fig. 6) show a shore alignment which is almost identical with that of 1830; the mouth has returned to its previous position and both Dukes Head and Point Frederick have essentially the form and dimensions shown on the 1830 map and that of the present time. The spit is now a narrow dune with a steep seaward face and with well established vegetation, except at the eastern end. There, where the mouth was in 1943, the dune appears lower and has only sparse vegetation. The 1943 river channel is now the Deadwater. At its western end there is a broad, shallow bar of mobile sand with a well defined deep channel to the river mouth. The eastern end has already silted up, though apparently still not vegetated.

#### 1975

The only significant differences between conditions in 1955 and those of the present time are the full development of the fore dune along its whole length and establishment of vegetation on it.

Rushes are well established at the eastern end of the Deadwater and the bar at the western end has consolidated and carries some vegetation. A narrow channel keeps open to the north of the bar, and tends to scour its northern shore.

#### Interpreting the changes

There have undoubtedly been considerable changes in the estuary and coastline during the Holocene and the Swan Lakes may be attributable to this period; however the close similarity between present topography and that of the period of 1830 to 1925 suggests that this is a stable form for the mouth and coastline at the present time. The events of 1925 to 1945 may have had purely natural causes. It has been suggested that a series of dry years allowed the bar to silt up in summer and so forced the river to erode its way eastward during reduced winter flows. The rainfall record gives little support

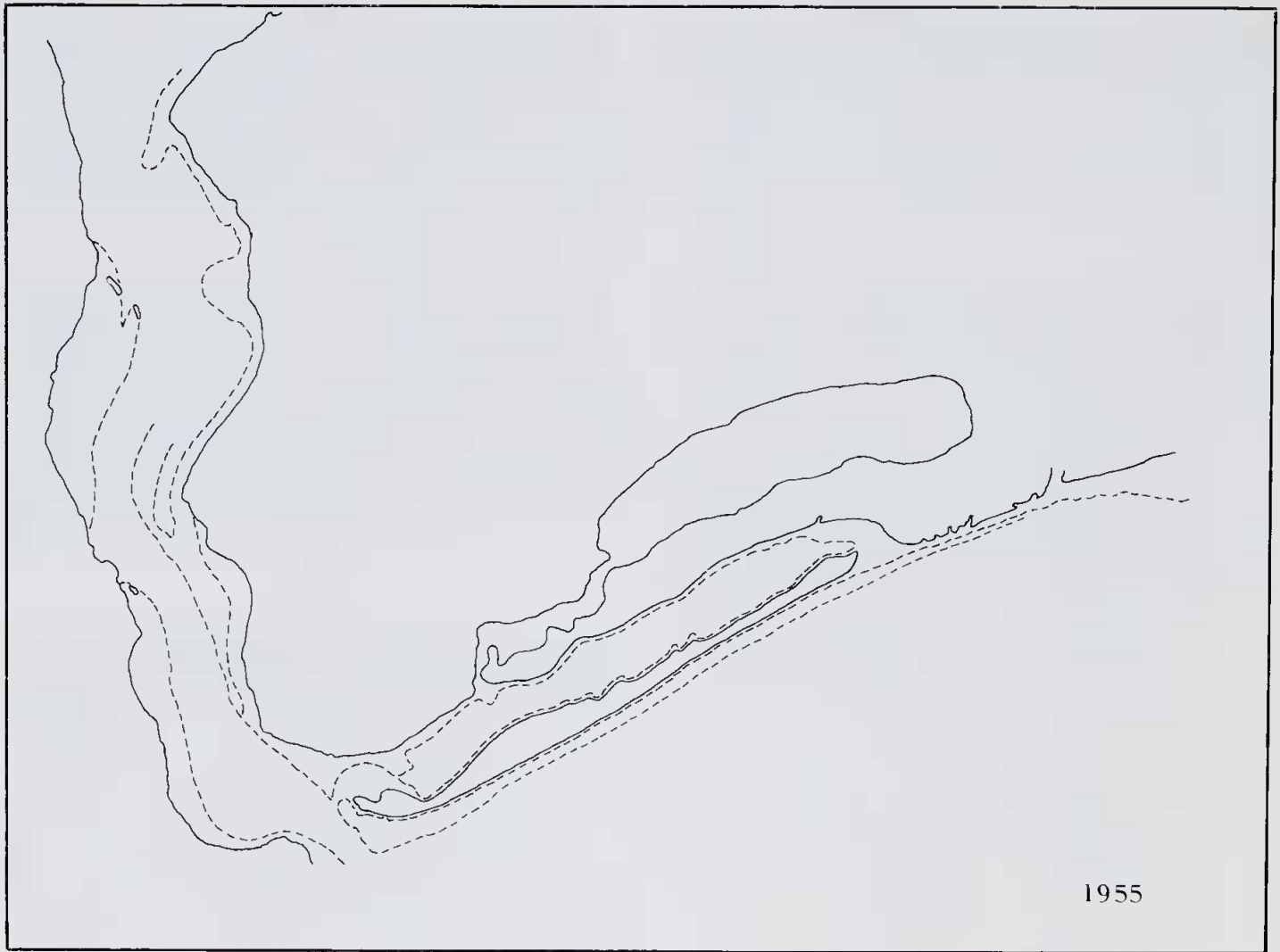


Figure 6.—Tracing from air photo of 1955.

to this explanation; 1925 was indeed a very dry year, but the following year was one of floods and the next eight years all had above average rainfall. Stormy seas may have cut back Point Frederick and transferred the sands to Dukes Head. There was just such a shift early in 1974 and continuation of such a process over several years could be expected to deflect the path of the river and increase the rate of erosion of Point Frederick. Alternatively growth of the spit may have been precipitated by human activities such as destruction of the vegetation on the east bank and consequent mobilisation of the sand; a big fire is said to have gone through the Deadwater area in the early 1920s. A number of possible hypotheses could be advanced.

The following explanation is proposed as best fitting the evidence available. Information additional to that recorded comes from members of the Ellis family who have owned property to the east of the Inlet since the turn of the century, and from various residents of Augusta.

Much of the land east of the Inlet was, and still is, used for grazing cattle and this includes the Deadwater area. This area provided good grazing behind the fore dunes; it would have been an inter-dune depression at the level of the

water table, separated from Swan Lake by low dunes and swampy ground as it is now. Rushy Creek flowed through this, draining fresh water from the lake to the estuary as shown on the 1832 map (Fig. 2). The lake floor then, as now, must have been below sea level. Wave action would have closed the mouth of the creek with sand each summer; no opening is shown on the chart surveyed April 1925. Water level built up in the lake in winter draining out slowly through Rushy Creek, and in spring the Ellis family cut through the sand bar releasing the water in order to take advantage of good grazing round the lowered lake; this is said to have been done each year for several years, and probably caused scouring of the creek.

Eventually some time in the 1920s failure of the sand bar to close allowed sea water to flow back into Swan Lake when there were unusually high tides. The 1943 air photo appears to show a later attempt to close the creek in two places between Swan Lake and the Deadwater. The salt water would have killed vegetation in the lake and flooded low-lying swampy ground between it and the fore dune killing vegetation here too. Add to this destruction of dune vegetation by fire on Point Frederick and the stage



was set for natural processes to take over; for Point Frederick to erode, for the mouth to migrate eastwards, and for a substantial sand spit to build out from Dukes Head.

What would have happened if a channel had not been cut through in 1945? Water level would have built up until before long the river would have broken through at the weakest point of the spit, perhaps where the cut was made, but perhaps again at the eastern mouth. In the latter event the sand spit might eventually have consolidated, a dune formed on it, and the river continued to flow through the Deadwater channel, but with the bar tending to close each summer because of reduced tidal exchange. How long this essentially unstable condition would have persisted it is impossible to say. The fact that after 1945 mouth and coastline rapidly reverted to their original condition suggests that there was not the necessary reservoir of mobile sand to permit the 1945 topography to consolidate and for a dune to build up on the spit.

### Conclusion

On the evidence presented it is concluded that the changes to the river mouth which took place during the decade 1925 to 1935 were precipitated by quite small scale human interference: cutting the bar at the mouth of Rushy Creek to drain Swan Lake and possibly burning the fore dune. Natural forces took over and built a substantial sand spit, a spit which diverted the course of the river and forced it to gouge out a new channel that carried the mouth 2.5 km eastwards until halted by high dunes. The Deadwater formed when the sand of the spit was remobilised following the reopening of the original mouth in 1945. This sand formed a bar which closed the connection of the diverted river with the mouth, leaving only a small tidal channel; some of it probably contributed to the shallow bank of mobile sand in the inlet opposite Seine Bay; it silted up the eastern end of the Deadwater; it regenerated Point Frederick and the fore dunes

to the east and returned the coastline to an alignment very close to that of 1830. There is no evidence of any net gain or loss of sand to the system.

The Deadwater is silting up slowly and, left to itself, it might eventually return to the 1830 condition. Tidal currents tend to keep its mouth open, but bars form both inside and outside this and there have already been requests to have a channel dredged through the mobile sand. Damage to the fore dunes on Point Frederick by beach buggies has been blamed for erosion of the point in 1974, but whether this is sufficient by itself to cause changes of the scale of those of 1925-1935 to be repeated is speculation only. The point has since largely regenerated though it will be some time before the vegetation is re-established. However, it is clear that there is a situation of uneasy balance in which quite small changes to the natural environment may precipitate major movements of the poorly consolidated sands near the mouth of the river.

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